CLAIMS

1. A diagnostic ultrasonic imaging system comprising:

a scanhead having a plurality of transducer elements, each of the transducer elements having a transducer element terminal;

a signal combiner coupled to the transducer element terminals, the signal combiner being structured to combine signals from a plurality of the transducer elements into a lesser number of combined output signals;

a communications link coupled to the signal combiner to receive each combined output signal;

a signal separator coupled to the communications link to receive each combined output signal, the signal separator being structured to separate each combined output signal into separate output signals corresponding to the signals combined to produce the combined output signal; and

an ultrasonic processor coupled to receive the separate output signals from the signal separator.

2. The diagnostic ultrasonic imaging system of claim 1 wherein the communications link comprises a wire.

3. The diagnostic ultrasonic imaging system of claim 1 wherein the signal combiner comprises a time-division multiplexer and the signal separator comprises a time-division demultiplexer.

4. The diagnostic ultrasonic imaging system of claim 3 wherein the time-division multiplexer comprises:

a first multiplexer circuit having a first plurality of terminals and a second terminal coupled to the communications link, the terminals in the first plurality being coupled to the transducer element terminal of respective transducer elements, the first multiplexer

circuit being responsive to a first digital control signal applied to a control input to couple the second terminal to each of the terminals in the first plurality.

5. The diagnostic ultrasonic imaging system of claim 4 wherein the time-division demultiplexer comprises:

a second multiplexer circuit having a first plurality of terminals coupled to the ultrasonic processor and a second terminal coupled to the communications link, the second multiplexer circuit being responsive to a second digital control signal applied to a control input to couple the second terminal to each of the terminals in the first plurality; and

a second counter incrementing responsive to the clock signal to generate a count to which the second digital control signal corresponds, the second counter being operable to apply the second digital control signal to the control input of the second multiplexer circuit.

6. The diagnostic ultrasonic imaging system of claim 4 wherein the time-division demultiplexer comprises:

an analog-to-digital converter having an input terminal coupled to the communications link and a digital output port coupled to the ultrasonic processor, the analog-to-digital converter being responsive to the clock signal to convert a voltage level received from the communication link to a corresponding digital value and apply the digital value to the digital output port.

7. The diagnostic ultrasonic imaging system of claim 3 wherein the time-division multiplexer comprises:

a sample-and-hold circuit having a plurality of input terminals each of which is coupled to a respective transducer element, the sample-and-hold circuit being operable to retain a sample of a signal coupled from each of the transducer elements and to provide the samples on respective output terminals;

a first multiplexer circuit having a first plurality of terminals and a second terminal, the terminals in the first plurality being coupled to respective output terminals of the

sample-and-hold circuit, the first multiplexer being responsive to a first digital control signal applied to a control input to couple the second terminal to each of the terminals in the first plurality.

8. The diagnostic ultrasonic imaging system of claim 7 wherein the time-division demultiplexer comprises:

a second multiplexer circuit having a first plurality of terminals coupled to the ultrasonic processor and a second terminal coupled to the communications link, the second multiplexer circuit being responsive to a second digital control signal applied to a control input to couple the second terminal to each of the terminals in the first plurality.

9. The diagnostic ultrasonic imaging system of claim 7 wherein the time-division demultiplexer comprises an analog-to-digital converter having an input terminal coupled to the communications link and a digital output port coupled to the ultrasonic processor, the analog-to-digital converter being responsive to the clock signal to convert a voltage level received from the communication link to a corresponding digital value and apply the digital value to the digital output port.

10. The diagnostic ultrasonic imaging system of claim 1 wherein the signal combiner comprises:

a plurality of frequency-division multiplexers coupled to the transducer element terminals of respective transducer elements, each of the frequency-division multiplexers generating a carrier signal modulated by an output signal from a respective transducer element, the modulated carrier signals from the frequency-division multiplexers being in different frequency bands; and

a signal summer coupled to receive the modulated carrier signals from the frequency-division multiplexers and apply a composite signal to the communications link.

11. The diagnostic ultrasonic imaging system of claim 10 wherein the signal separator comprises a plurality of frequency-division demultiplexers substantially

corresponding in number to the number of frequency-division multiplexers, the frequency-division multiplexers each having an input coupled to the communications link and an output coupled to the ultrasonic processor.

12. The diagnostic ultrasonic imaging system of claim 11 wherein the frequency-division multiplexers comprise respective amplitude modulators and wherein the frequency-division demultiplexers comprise respective amplitude demodulators.

13. The diagnostic ultrasonic imaging system of claim 11 wherein the frequency-division multiplexers comprise respective frequency modulators and wherein the frequency-division demultiplexers comprise respective frequency demodulators.

14. A method of coupling signals from respective transducer elements in an ultrasonic scanhead to an ultrasonic processor, the method comprising:

at the scanhead, combining the signals from a plurality of transducer elements into a composite signal;

coupling the composite signal from the scanhead to the ultrasonic processor; and

at the ultrasonic processor, separating the composite signal into a plurality of components each of which corresponds to a signal from a respective transducer element.

15. The method of claim 14 wherein the act of coupling the composite signal from the scanhead to the ultrasonic processor comprises coupling the composite signal from the scanhead to the ultrasonic processor through a wire.

16. The method of claim 14 wherein the act of coupling the composite signal from the scanhead to the ultrasonic processor comprises coupling the composite signal from the scanhead to the ultrasonic processor through an optical communications link.

17. The method of claim 14 wherein the act of coupling the composite signal from the scanhead to the ultrasonic processor comprises coupling the composite signal from the scanhead to the ultrasonic processor through a radio communications link.

18. The method of claim 14 wherein the act of combining the signals from a plurality of transducer elements into a composite signal comprises time-division multiplexing the signals from the transducer elements, and wherein the act of separating the composite signal into a plurality of components comprises time-division demultiplexing the composite signal.

19. The method of claim 18 wherein the act of time-division multiplexing the signals from the transducer elements comprises sequentially coupling signals from each of the transducer elements to the ultrasonic processor.

20. The method of claim 18 wherein the act of time-division multiplexing the signals from the transducer elements comprises:

sampling the signals from the plurality of transducer elements;

combining the samples; and

coupling the samples from the scanhead to the ultrasonic processor.

21. The method of claim 20 wherein the act of sampling the signals from the plurality of transducer elements comprises sequentially sampling the signals from the plurality of transducer elements.

22. The method of claim 20 wherein the act of sampling the signals from the plurality of transducer elements comprises simultaneously sampling the signals from the plurality of transducer elements.

23. The method of claim 18 wherein the act of time-division demultiplexing the composite signal comprises:

periodically determining the amplitude of the composite signal;

generating a digital value corresponding to each of the determined amplitudes; and

coupling each of the digital values to the ultrasonic processor through a respective terminal of the ultrasonic processor.

24. The method of claim 18 wherein the act of time-division multiplexing the signals from the transducer elements comprises sequentially coupling each of the transducer elements to a communications link to create the composite signal, and wherein the act of time-division demultiplexing the composite signal comprises sequentially coupling the communications link to each of a plurality of input terminals of the ultrasonic processor, the sequential coupling of the communications link to the input terminals being in synchronism with the coupling of the transducer elements to the communication link.

25. The method of claim 14 wherein the act of combining the signals from a plurality of transducer elements into a composite signal comprises frequency-division multiplexing the signals from the transducer elements to create the composite signal, and wherein the act of separating the composite signal into a plurality of components comprises frequency-division demultiplexing the composite signal.

26. The method of claim 25 wherein the act of frequency-division multiplexing signals from a plurality of transducer elements comprises modulating carriers of different frequencies with each of the signals from the transducer elements, and wherein the act of frequency-division demultiplexing the composite signal comprises demodulating the composite signal to produce an output signal at each carrier frequency.

27. The method of claim 26 wherein the act of modulating carriers of different frequencies with each of the signals from the transducer elements comprises

frequency modulating the carriers with respective output signals from the transducer elements, and wherein the act of demodulating the composite signal comprises frequency demodulating the composite signal.

28. The method of claim 26 wherein the act of modulating carriers of different frequencies with each of the signals from the transducer elements comprises amplitude modulating the carriers with respective output signals from the transducer elements, and wherein the act of demodulating the composite signal comprises amplitude demodulating the composite signal.

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